

## **Analysis of Amphetamine & Methamphetamine**

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- 1. Background**  
Amphetamine & Methamphetamine
- 2. Objective**  
The objective of this SOP is to establish guidelines to be used for the analysis of a sample that may contain amphetamine, methamphetamine and related phenethylamine.
- 3. Scope**  
This SOP is to be used by the laboratory staff of the Division of Analytical Chemistry at William A. Hinton State Laboratory Institute in Boston, MA.
- 4. Responsibility**  
Chemists are responsible for acquiring glassware, preparing chemical reagents and standards, sample analysis, and reporting. Chemists also perform instrument calibrations, maintenance and troubleshooting, ordering of supplies and other necessary tasks related to this analysis.

Technical Reviewers will review each case and complete the comprehensive reviewer checklist. They will ensure that the chemist followed this SOP. The Technical Reviewer may perform the duties and responsibilities of the chemist.

Laboratory Supervisors ensure that chemists are following this SOP. They may perform the duties of the chemists and must review raw data and reports generated by chemists. The Supervisor may advise the chemists of alternative testing methods. They ensure that quality control measures are within acceptable limits and determine when corrective actions are needed. They coordinate proficiency testing (PT), reporting and distribution of PT results. They oversee sample results distribution to outside agencies.

Directors ensure that the SOP is being followed and reviewed on a regular basis. They provide approval of standard operating procedures and review quality control documentations.

## 1. Related Documents

Cole, Michael, "The Analysis of Controlled Substances," London: John Wiley & Sons Ltd., 2003  
Drug Enforcement Administration, "Basic Training Program for Forensic Drug Chemists," Drug Enforcement Administration.  
Mills III, Terry et al, "Instrumental Data for Drug Analysis," 3<sup>rd</sup> ed., 6 vols., New York: CRC Press, 2006.  
Moffat, A.C. et al, "Clarke's Isolation and Identification of Drugs," 2<sup>nd</sup> ed., London: The Pharmaceutical Press, 1986.  
Moffat, A.C. et al. "Clarke's Analysis of Drugs and Poisons," 3<sup>rd</sup> ed., London: The Pharmaceutical Press, 2004.  
Saferstein, Richard, "Forensic Science Handbook," New Jersey: Prentice Hall, 1988.  
Scientific Working Group for the Analysis of Seized Drug Recommendation, 6<sup>th</sup> ed., "Part III A & B, Methods of Analysis/Sampling of Seized Drug for Qualitative Analysis," July 2011

## 6. Definitions

GC w/ FID: Gas Chromatography with Flame Ionization Detector  
GC/MS: Gas Chromatography/Mass Spectrometry  
Gross Weight: The weight of both the substance and its container.  
Net Weight: The weight of the substance only.  
UV/Vis: Ultraviolet Visible Spectrophotometer

## 7. Supplies, Equipment & Reagents

### Supplies

GC columns  
HP-1MS (Agilent, Cat # 19091S-933UI or equivalent)  
HP-5MS (Agilent, Cat # 19091S-433UI or equivalent)  
GC crimp vials  
Clear (Agilent, 2mL, Cat # 5182-0543 or equivalent)  
Amber (Agilent, 2mL, Cat # 5181-3376 or equivalent)  
Clear (Agilent, 0.8mL, Cat# or equivalent)  
Kimwipes  
Pasteur pipette  
Porcelain spot plate

Scissors  
Spatula  
Stirring rod  
Teflon crimp (top) caps  
    Silver (Agilent, Cat # 5181-1210 or equivalent)  
    Blue (Agilent, Cat # 5181-1215 or equivalent)  
Various Class A glassware  
    Beakers  
    Graduated cylinders  
    Volumetric flask (range 10mL to 50mL)  
Weighing dish (VWR, Anti-Static, Cat # 89106 or equivalent)  
Weighing paper (VWR, Cat # 12578 or equivalent)

### **Equipment**

Analytical Balance (range 0.0001g to 1.0g)  
GC with FID (Agilent, Model # 7890 Series or equivalent)  
GC/MS (Agilent, Model # 5975 Series or equivalent)  
UV-Vis (Beckmann-Coulter, Model # or equivalent)

### **Reagents**

Acetone (JT Baker, Ultra Resi-Anhydrous, Cat # 9254 or equivalent)  
Chloroform (JT Baker, ACS Grade, Cat # 9180 or equivalent)  
Cobalt thiocyanate (Aldrich, Cat # 216135 or equivalent)  
Cobaltous acetate tetrahydrate (Fisher Scientific, Certified, Cat # C364 or equivalent)  
Deionized water (in-house)  
Formaldehyde, 37% wt solution (Acros Organic, ACS Grade, Cat # AC41073 or equivalent)  
Glacial acetic acid (JT Baker, ACS Grade, Cat# 9511 or equivalent)  
Hexane  
Hydrochloric acid (JT Baker, ACS Grade, Cat # 9535 or equivalent)  
Isopropylamine (Acros Organic, 99%, Cat # AC14892 or equivalent)  
Methanol (JT Baker, ACS Grade, Cat # 9070 or equivalent)  
Selenous acid (Acros Organic, 99.999%, Cat # 43712 or equivalent)  
Sodium Hydroxide  
Sodium molybdate (JT Baker, ACS Grade, Cat # 3764 or equivalent)  
Sulfuric acid (JT Baker, ACS Grade, Cat # 9681 or equivalent)

### **Standards**

Cocaine hydrochloride (USP, Cat # 14300 or equivalent)  
Codeine phosphate (Grace-Alltech, Cat # 01801 or equivalent)  
Dextroamphetamine sulfate (USP, Cat # 1180004 or equivalent)  
Ephedrine  
Methamphetamine hydrochloride (USP, Cat # 1399001 or equivalent)

## **8. Safety**

Due to the potential hazards, appropriate precautions should be taken as necessary. This includes, but is not limited to, the use of fume hoods, gloves, masks and safety glasses. Lab coats are to be worn at

all times in the unit, unless performing administrative duties.

## 9. Reagent/Standard Preparation

### Cobalt Thiocyanate Reagent

Dissolve 2.0g of cobalt thiocyanate in 100mL of deionized water. Mix the solution until completely dissolved.

### Marquis Reagent

Dilute 10mL of 37% formaldehyde solution in 90mL of concentrated sulfuric acid. While stirring, slowly add the concentrated sulfuric acid to the formaldehyde solution. Allow the solution to cool completely.

### Froedhde's Reagent

Dissolve 0.5g of sodium molybdate in 100mL of concentrated sulfuric acid. Mix the solution until completely dissolved.

### Mecke's Reagent

Dissolve 1.0g of selenous acid in 100mL of concentrated sulfuric acid. Mix the solution until completely dissolved.

### 2.8N Hydrochloric Acid Reagent

Dilute 92.6mL of 12.1N hydrochloric acid in 400mL of deionized water. Mix the solution until completely.

### Cocaine/Codeine Standard (QC Mix)

Dissolve 10.0 mg of cocaine hydrochloride and 10.0mg of codeine phosphate and bring to volume with 10mL of methanol. Mix the solution until completely dissolved.

### 0.1N Sodium Hydroxide Reagent

Dissolved 0.8g of sodium hydroxide in 200mL of deionized water. Mix the solution until completely dissolved.

### Dextroamphetamine Standard

Dissolved 10.0mg of dextroamphetamine sulfate in 2mL of 0.1N sodium hydroxide in a 10mL volumetric flask and allow the solution to solubilize for about 1-3 hours. Then extract with 10mL of hexane. Mix the solution gently.

### Methamphetamine Standard

Dissolved 10.0mg of methamphetamine hydrochloride in 2mL of 0.1N sodium hydroxide in a 10mL volumetric flask and allow the solution to solubilize for about 1-3 hours. Then extract with 10mL of hexane. Mix the solution gently.

### Ephedrine Stock

## 10. Procedure

{ DATE \@ "M/d/yyyy" }

**A. Evidence Handling**

- i. Evidence Officer will randomly assign sample to a chemist.
- ii. The chemist will perform an evidentiary check on the sample. They will verify that the manila envelop, control card and the evidence correspond. They will observe the integrity of the evidence bag and its contents.
- iii. Once the sample has been verified, the chemist will take custody of the samples by signing out the evidence in the chain of custody logbook.
- iv. The sample will be brought to the chemist work area and stored in a secure manner at all times.
- v. Upon analysis of each sample, the chemist will document all observations on the Drug Analysis Form.
- vi. The information on the Drug Analysis Form will contain but not limited to the sample number, submitting agency, verification of the evidence gross weight, number of samples, container, description of sample, gross, package and net weight, ballistics notation, chemist notations and results, preliminary and confirmatory findings.

**B. Sampling Plan**

- i. (to be determine)

**C. Residues**

- i. Attempt to scrape or remove sample from the device and place onto weighing paper or boat. Or rinse the device containing the sample with 1-2ml of the chloroform and place the extract into a beaker.
- ii. Transfer some of the sample or extract into a labeled residue vial for GC and GC/MS analysis. Residue samples should be dissolved or diluted in chloroform. Cap and seal the vial tightly.
- iii. Use the remaining sample or extract to perform the color test.

**D. Color Test**

- i. The color test consists of four reagents, which are cobalt thiocyanate, marquis, froehde's, and mecke's.
- ii. For powdered substances, place a couple of drops of cobalt thiocyanate, marquis, froehde's, mecke's reagents into four individual wells on a porcelain spot plate. Then add a small amount of sample (1-2mg of powder) to each well. Note any color change or reaction.
- iii. For liquid substances, add a small amount of sample (1-2 drops) into four individual wells on a porcelain spot plate and allow the sample to dry completely. Then place a couple of drops of cobalt thiocyanate, marquis, froehde's, mecke's reagents into each well. Note any color change or reaction.
- iv. The results will be recorded on the Drug Analysis Form by documenting the actual color/s observed. Negative observations will be recorded by stating no reaction or no color change.

**E. Interpretation**

- i. Marquis reagent: Formation of an orange to brown color indicates the possible presence of amphetamine, methamphetamine, fentanyl or phentermine.

**F. Ultraviolet/Visible Spectrophotometer**

- i. Place about 1-2mg of sample into a labeled culture tube.
- ii. Add about 2mL of 0.1N sulfuric acid to the labeled culture tube and mix gently until dissolved.

- iii. Place 2-3mL of 0.1N sulfuric acid in a clean cuvette and place into the cuvette holder. Initiate the instrument to perform a blank analysis. (Blanks will be run between each unknown sample and reference standard.)
- iv. Place 2-3mL of ephedrine stock solution into a cuvette and place into the cuvette holder. Initiate the instrument to perform a standard analysis.
- v. Place 2-3mL of the unknown sample into a cuvette and place into the cuvette holder. Initiate the instrument to perform a sample analysis.
- vi. Print the spectra of all the unknown samples, reference standards and blanks.
- vii. Positive UV analysis will be recorded on the Drug Analysis Form by the use of a plus (+). The result is considered positive when the retention time of the sample and the reference standard meet the laboratory criteria and are specified in the notes. Negative observations will be recorded by the use of a negative (-).

**G. Base Conversion**

- i. Place about 1-3mg of the sample into a labeled culture tube.
- ii. Add about 1-2mL of 0.1N sodium hydroxide into the labeled culture tube. Allow the sample to solubilize for about 2-3 hours.
- iii. Add about 1-2mL of hexane to the labeled culture tube and mix gently.
- iv. Remove the hexane layer from the solution. Transfer the extract into a labeled GC vial and cap tightly.

**H. Gas Chromatography Screen (as necessary)**

- i. The extract from the previous section (G) can be used for the GC analysis.
- ii. Initiate auto sampler sequence using the GENSCAN method running a blank solvent between each unknown sample and reference standard/s.
- iii. Compare retention time of the each sample with the reference standard/s. Also check the chromatograph to determine if the sample needs to be diluted or concentrated.
- iv. Positive GC analysis will be recorded on the Drug Analysis Form by the use of a plus (+). The result is considered positive when the retention time of the sample and the reference standard meet the laboratory criteria and are specified in the notes. Negative observations will be recorded by the use of a negative (-).

**I. Gas Chromatography/Mass Spectrometry**

- i. Confirmatory analysis can be performed using the GC vial from the previous section (H).
- ii. Initiate auto sampler sequence using the SPEED method running a blank solvent between each unknown sample and reference standard/s.
- iii. Compare retention time and ion spectra of the each sample with the reference standard/s (Amphetamine or Methamphetamine).
- iv. Document the date analyzed and results of the GC/MS onto the MS Tracking Sheet, Drug Analysis Form and Control Card.

**J. Criteria for Gas Chromatography/Mass Spectrometry**

- i. Retention time of the sample must be within +/- 1.5% of the reference standard.
- ii. Library spectra match must be > 90%.
- iii. There must be a visual spectral match between the reference standard and the sample.
- iv. At least 5 of the major ions must be present for the sample.

**11. Documentation**

- A. All results will be documented on the Drug Analysis Form.

{ DATE \@ "M/d/yyyy" }

- B. All raw data will be generated and filed according to the laboratory policy.
- C. A certificate of analysis will be generated for each lab number which will document the results.

## **12. Attachments**

### **GC Method**

### **GC/MS Method**